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⑪ Publication number:

0 106 289
B1

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EUROPEAN PATENT SPECIFICATION

⑯ Date of publication of patent specification: **18.05.88**

⑯ Int. Cl.⁴: **D 06 F 58/22**

⑰ Application number: **83110046.6**

⑰ Date of filing: **07.10.83**

④ Laundry dryer with a lint filter monitoring device.

③ Priority: **08.10.82 IT 3404282 u**

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④ Date of publication of application:
25.04.84 Bulletin 84/17

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⑤ Publication of the grant of the patent:
18.05.88 Bulletin 88/20

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⑧ Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

⑨ References cited:
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US-A-2 722 751
US-A-3 287 818
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Description

The present invention relates to a laundry dryer having a filter inserted in a duct for the circulation of heated drying air, and a monitoring device for detecting the operative condition of said filter.

Conventional laundry dryers comprise a blower and heater elements for circulating heated air through the interior of a drum containing the laundry to be dried by way of an air duct.

Inserted in said air duct is a filter adapted to retain lint and possibly present foreign bodies. Such filter is provided with monitoring means connected to the heater elements and to electric motors driving said blower and said drum by means of an electric circuit adapted to switch between two operative conditions. In the first such condition, with the filter functioning properly, this circuit supplies all the electric components of the machine in a regular manner. In the second such condition, with the filter clogged, the speed of the circulating heated air is reduced, and the temperature interiorly of the drum is increased, with the risk of the laundry being singed or burnt.

There have already been proposed various types of filter monitoring devices for detecting the latter operative condition and for interrupting the current supply to the electric components of the machine. A first type of such monitoring device is formed by a temperature sensor adapted to detect an excessive rise of the air temperature within the machine or an overheating condition of the heater elements.

A monitoring device of a second type comprises a pneumatic sensor adapted to detect the pressure difference of the heated air between the upstream and the downstream side of the filter.

A further monitoring device comprises a mechanical sensor responsive to variations of the air flow rate downstream of the filter.

The described monitoring devices thus carry out indirect measurements of the operative condition of the filter in a laundry dryer, so that, in case of failure of other functional components of the dryer, they are apt to erroneously indicate malfunction of the filter, and are thus not fully reliable for the stated purpose.

Also known are monitoring devices directly cooperating with the filter, such devices comprising for instance an optical sensor for detecting the translucency, and thus the degree of clogging, of the filter. Also in this case, however, the obtained measurements of indicative of the operative condition of the filter may be erroneous due to the accumulation of dust on the optical sensor or to drifting of the sensor's adjustment, so that these devices are likewise unsuitable for obtaining satisfactory and reliable results.

It is finally to be noted that all of the described monitoring devices are of intricate construction and require periodic adjustment.

It is therefore an object of the present invention to provide a filter monitoring device of simple construction, which is reliable in operation and avoids the necessity of periodic adjustment.

These and other objects are attained according to the invention in a laundry dryer comprising a blower and at least one heater element for circulating heated air through the interior of a drum containing the laundry to be dried by way of an air duct including a filter associated with a monitoring device connected to said heater element and to electric motors of said blower and said drum through an electric circuit adapted to switch between two operative conditions.

In accordance with the invention, a laundry dryer of the type indicated above is characterized in that said monitoring device comprises at least two sensor electrodes disposed in spaced relationship and electrically insulated from one another adjacent said filter for measuring the electric conductivity of lint progressively accumulating on the active filter surface.

Further characteristics and advantages of the invention will become evident from the following description of exemplary embodiments thereof, with reference to the accompanying drawings, wherein:

Fig. 1 shows a diagrammatic cross-sectional view of a laundry dryer according to the invention,

Fig. 2 shows a perspective view of a filter for mounting in the laundry dryer of Fig. 1, in a first embodiment of the invention and

Fig. 3 shows a perspective view of a filter constructed in accordance with a second embodiment of the invention.

With reference to Fig. 1, a laundry dryer according to the invention comprises a housing 4 enclosing a perforated drum 5 for containing the laundry to be dried, mounted for rotation about its horizontal axis under the action of an electric motor (not shown). In particular, drum 5 is provided with a rear portion 6 formed with perforations 7. The dryer further comprises a front opening 8 closed by a door 9 giving access to drum 5 and being provided with a perforated interior wall 10. The rear side of the dryer is formed with openings 11 for the aspiration of air which is conveyed to the interior of drum 5 by way of an inlet duct 12 connected to rear portion 6 of drum 5 and enclosing at least one electric heater element 13. From drum 5 the heated air is exhausted through perforated wall 10 and conveyed to an outlet opening 14 by way of a further air duct 15 having a motor-driven blower installed therein.

In addition, duct 15 is provided with at least one filter 17 inserted thereinto through inlet opening 18 and serving to retain any lint set free by the laundry and any foreign matter possibly carried along in the air stream, and with a device for monitoring the operative condition of filter 17.

As diagrammatically shown in Fig. 2, filter 17 in a first embodiment of the invention comprises two complementary frames 19 and 20 formed of a suitable insulating material and enclosing each a metallic filtering surface 21, 22 of a fine mesh structure. Frames 19 and 20 are hingedly connected to one another along adjacent edges 23, 24, so that the filter can be opened in the manner of a book for cleaning and lint removal.

The opposite free edge portions 27, 28 of frames 19, 20 are formed with mutually engageable means 25, 26 for retaining the two frames in a partially closed position, in which they form an acute angle between themselves, so as to maintain a certain distance between filtering surfaces 21, 22. In this embodiment, the above named monitoring device is formed by the two filtering surfaces 21, 22 of the filter 17 itself, which to this effect additionally perform the function of sensory electrodes for detecting the degree of clogging of the filter in a manner to be described. The thus formed sensor electrodes are electrically insulated from one another by the respective frames 19, 20, and connected to the electric circuit of the dryer including heater element 13 and the electric motors driving drum 5 and blower 16.

The monitoring device of this embodiment basically functions through measurement of the varying electric conductivity of the lint accumulating between the filtering surfaces of the filter during the operation of the dryer, during which the filter is traversed by a stream of moist air.

As the accumulating lint is moist, its fibers act as electric conductors, permitting a weak current to flow across the sensor electrodes. This current may then be measured by means of a conventional electronic device connected to the sensor electrodes and to optical or acoustical signal means of any known type.

The described monitoring device is adjusted so as to remain inactive as long as the lint progressively accumulating on the filter allows a sufficient flow of heated air to pass therethrough for ensuring satisfactory drying of the laundry at temperatures lying between predetermined limits.

Under these conditions the signalling means is not activated, while electric heating element 13 and the above described motors continue to be supplied with current from the program unit of the machine (not shown).

Only when the filter becomes substantially clogged with lint, so that the speed of the air flow passing through the filter is decreased and the laundry within the drum is being dried at excessive temperatures with the danger of the laundry being damaged thereby, the monitoring device is activated in the described manner.

Under this condition the signal means is automatically activated to indicate to the user that the filter is completely clogged, while the heater element 13 and the motors are deenergized so as to interrupt the operating cycle of the dryer and to avoid any damage to the laundry.

Filter 17 may then be extracted from the dryer, thoroughly cleaned of the lint adhering thereto, and returned to its position for completing the interrupted drying cycle.

In the modified embodiment of the invention shown in Fig. 3, the filter comprises a single frame 29 formed of a suitable insulating material and enclosing a fine-mesh filtering surface 30.

In this embodiment the sensor electrodes are formed as metallic rods 31, 32 transversely

affixed to filtering surface 30 in spaced positions and, if the filter surface 30 is formed of metal or another electrically conductive material, with the interposition of insulating supports 33 and 34, respectively.

As in the above described first embodiment, the sensor electrodes are connected to the electric circuit of the machine so as to indicate the operative condition of the filter in a similar manner. Within the scope of the invention it is of course possible to design the sensor electrodes in any other suitable manner as long as it is ensured that they can be effectively short-circuited by an accumulation of moist lint so as to be able to measure the electric conductivity thereof.

The described monitoring device is of simple construction, of convenient use and adapted to directly, accurately and reliably detect the operative condition of the filter without the necessity of periodic adjustment and of employing structurally complicated monitoring devices of the types described in the introduction.

Claims

1. A laundry dryer comprising a blower (16) and at least one heater element (13) for circulating heated air through the interior of a drum (5) containing laundry to be dried by way of an air duct including a filter (17) associated with a monitoring device connected to said heater element (13) and to electric motors of said blower (16) and said drum (5) through an electric circuit adapted to be switched between two operative conditions, characterized in that said monitoring device comprises at least two sensor electrodes (21, 22) disposed in spaced relationship and electrically insulated from one another adjacent said filter (17) so as to measure the electric conductivity of lint progressively accumulating on the active filter surface.

2. A laundry dryer according to claim 1, characterized in that each said sensor electrode is formed by a metallic filtering surface portion (21, 22) of said filter (17) enclosed in a frame (19, 20) of an insulating material, said frames (19, 20) being hingedly connected to one another along adjacent edges and provided with mutually engageable means (25, 26) adjacent their free edges (27, 28).

3. A laundry dryer according to claim 1, characterized in that said sensor electrodes are formed as metallic rods (31, 32) affixed in spaced relationship to only one filtering surface (30) of said filter with the possible interposition of respective insulating supports (33, 34).

Patentansprüche

1. Wäschetrockner mit einem Gebläse (16) und wenigstens einem Heizelement (13) zum Umläufen erwärmter Luft durch den Innenraum einer Trommel (5), die zu trocknende Wäsche enthält, mittels einer Luftleitung, die ein Filter (17) enthält, dem eine Überwachungseinrichtung zugeordnet

ist, die mit dem Heizelement (13) und elektrischen Motoren des Gebläses (16) und der Trommel (5) über eine elektrische Schaltung verbunden ist, die geeignet ist, zwischen zwei Betriebszuständen umgeschaltet zu werden, dadurch gekennzeichnet, daß die Überwachungseinrichtung wenigstens zwei Sensorelektroden (21, 22) aufweist, die in gegenseitigem Abstand und elektrisch isoliert voneinander benachbart dem Filter (17) angeordnet sind, um die elektrische Leitfähigkeit von Flusen zu messen, die sich allmählich auf der aktiven Filterfläche anaccmeln.

2. Wäschetrockner nach Anspruch 1, dadurch gekennzeichnet, daß jede Sensorelektrode von einem metallischen Filterflächenabschnitt (21, 22) des Filters (17) gebildet ist, der in einem Rahmen (19, 20) aus einem isolierenden Material eingeschlossen ist, wobei die Rahmen (19, 20) schwenkbar aneinander längs benachbarter Ränder befestigt sind und mit in gegenseitigen Eingriff bringbaren Einrichtungen (25, 26) benachbart ihrer freien Ränder (27, 28) versehen sind.

3. Wäschetrockner nach Anspruch 1, dadurch gekennzeichnet, daß die Sensorelektroden als metallische Stäbe (31, 32) ausgebildet sind, die im Abstand zueinander an nur einer Filterfläche (3) des Filters befestigt sind, wobei ggf. jeweils isolierende Stützen (33, 34) dazwischen angeordnet sind.

Revendications

1. Machine à sécher le linge comprenant une

soufflante (16) et au moins un élément chauffant (13) pour faire circuler de l'air chaud à travers l'intérieur d'un tambour (5) contenant le linge à sécher par l'intermédiaire d'un conduit d'air contenant un filtre (17) associé à un dispositif de surveillance raccordé à cet élément chauffant (13) et aux moteurs électriques de la soufflante (16) et du tambour (5) par l'intermédiaire d'un circuit électrique adapté pour être commuté entre deux états de fonctionnement, caractérisée en ce que ce dispositif de surveillance comprend au moins deux électrodes de détection (21, 22), espacées et électriquement isolées l'une de l'autre, disposées adjacentes au filtre (17) de façon à mesurer la conductivité électrique des peluches qui s'accumulent progressivement sur la surface active du filtre.

2. Machine à sécher le linge selon la revendication 1, caractérisée en ce que chaque électrode de détection est formée par une portion de la surface filtrante métallique (21, 22) de ce filtre (17) entourée par un cadre (19, 20) en un matériau isolant, ces cadres (19, 20) étant articulés l'un à l'autre le long de bords adjacents et comportant des moyens (25, 26) pouvant coopérer ensemble au voisinage de leurs bords libres (27, 28).

3. Machine à sécher le linge selon la revendication 1, caractérisée en ce que ces électrodes de détection se présentent sous la forme de tiges métalliques (31, 32) fixées, à distance l'une de l'autre, sur seulement une surface filtrante (30) du filtre avec interposition éventuelle de supports isolants respectifs (33, 34).

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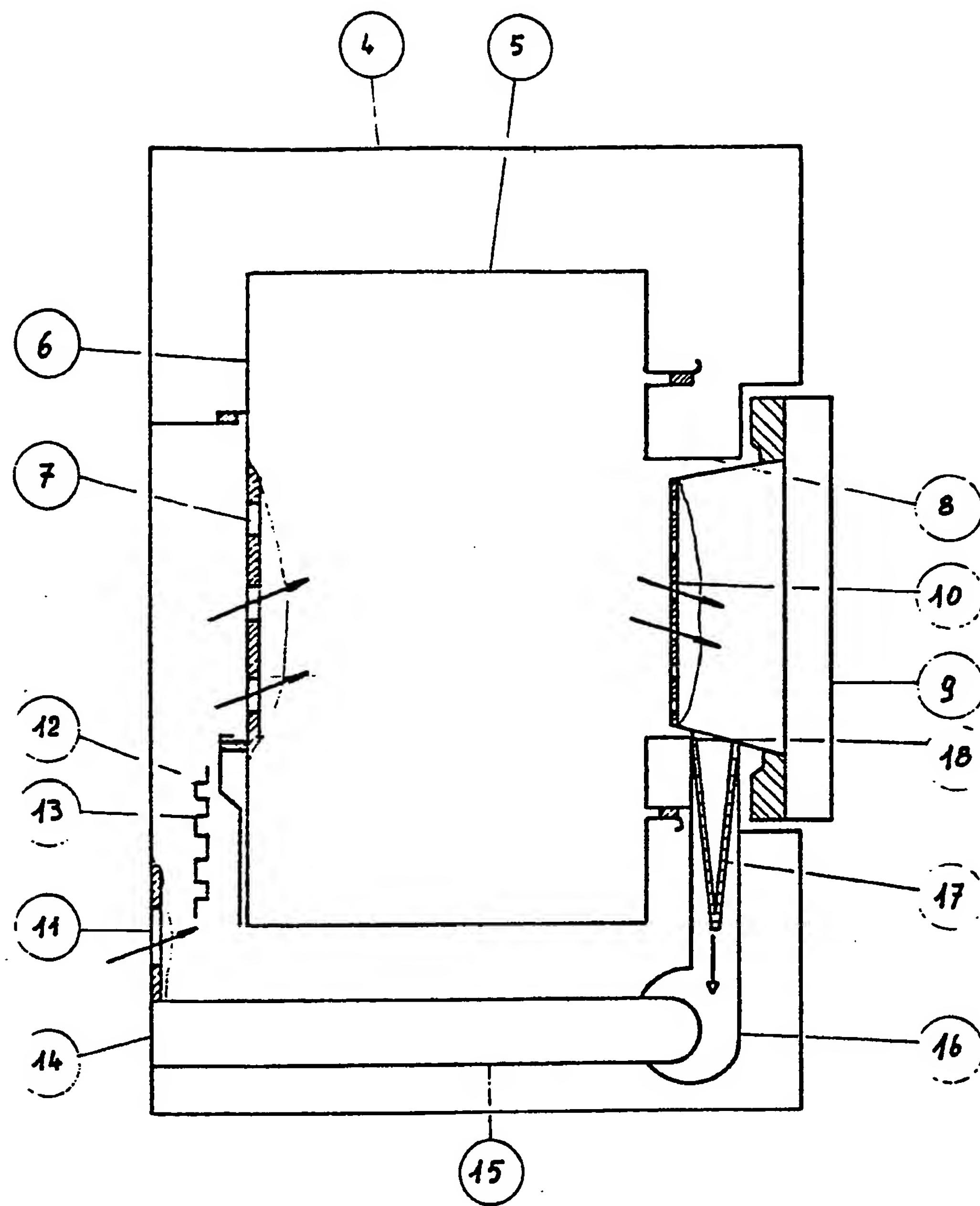


FIG. 1

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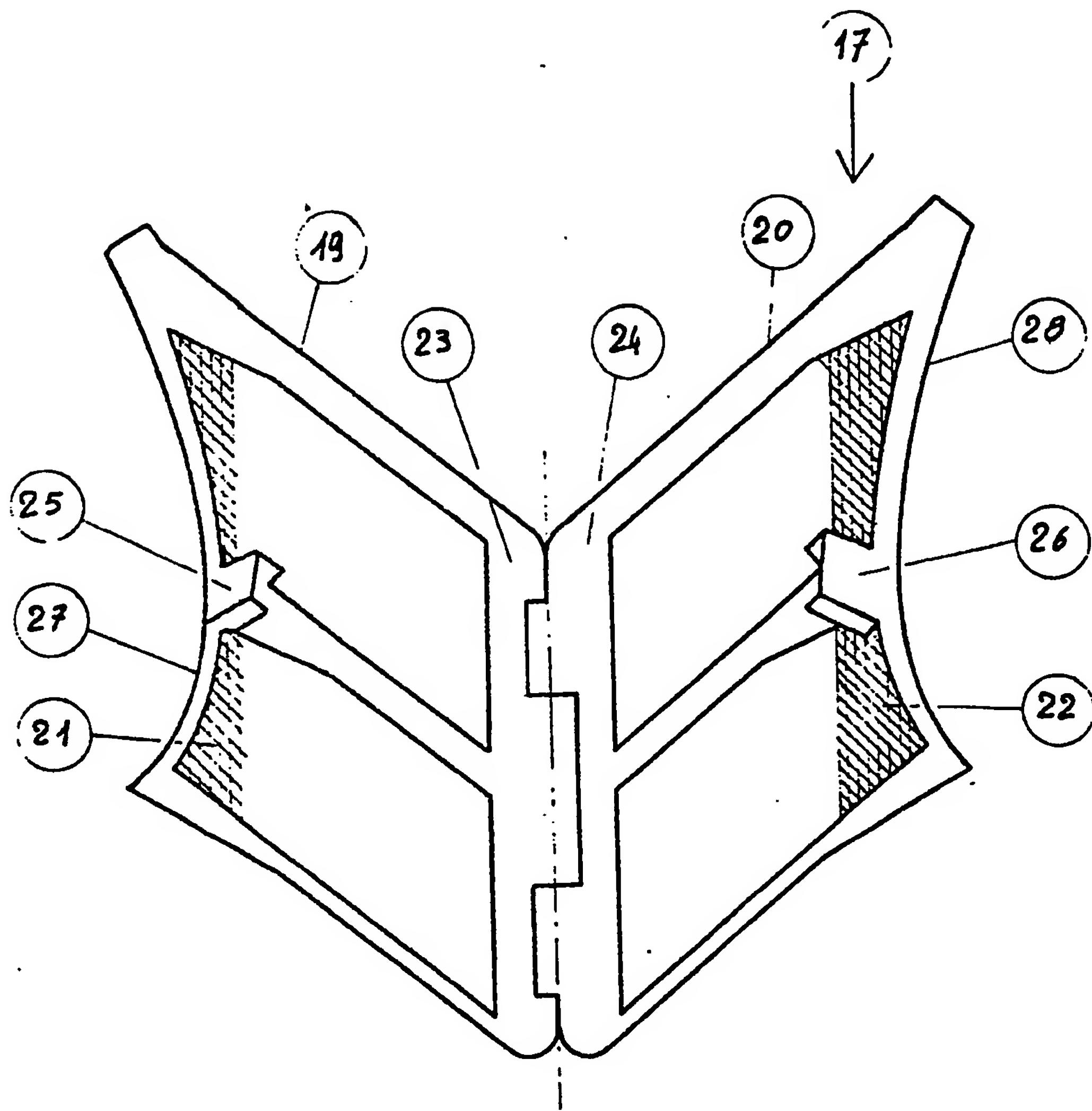


FIG. 2

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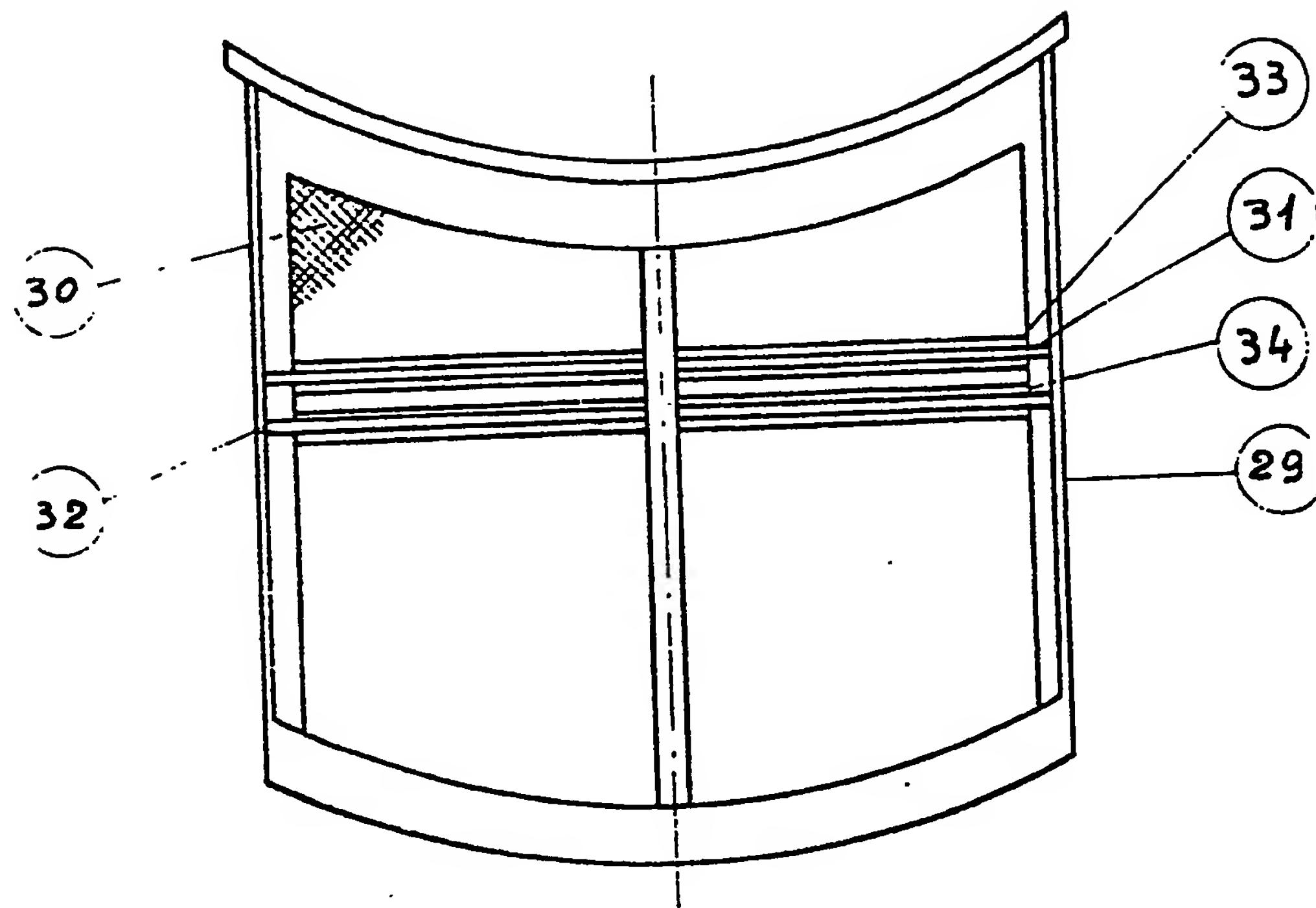


FIG. 3